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(71) Applicant : SUN MICROSYSTEMS, INC.  
2550 Garcia Avenue  
Mountain View, CA 94043 (US)

(72) Inventor : Owens, Gary L.  
111 N. Rengstorff, Apt. 173  
Mountain View, California 94043 (US)  
Inventor : Labuda, David  
213 Correas Avenue  
Half Moon Bay, California 94019 (US)

(74) Representative : Wombwell, Francis  
Potts, Kerr & Co. 15, Hamilton Square  
Birkenhead Merseyside L41 6BR (GB)

(54) Automated software installation and operating environment configuration on a computer system.

(57) A boot device, a local or remote install media, and a local or remote storage device are provided to a computer system. The boot device comprises an install media locator and starter module. The local or remote install media comprises an install set up and control module and an install module. The local or remote storage device comprises a defaulted or a customized collection of installation files. The defaulted/customized collection of install files comprise a classification rules file, a number of pre-install class script files, a number of install class parameter files, and a number of post-install class script files. Together, these elements cooperate to automatically install software products on the computer system, and configure the operating environment of the computer system.

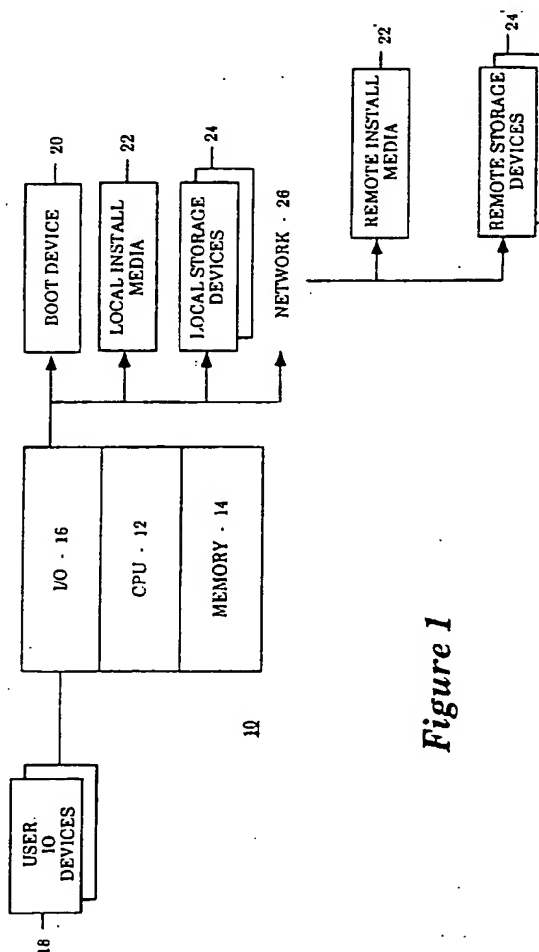


Figure 1

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## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention:**

The present invention relates to the field of computer systems, in particular, microprocessor based computer systems connected as a network. More specifically, the present invention relates to installing software products and configuring operating environments on these computer systems.

### **2. Background:**

As cost performance of microprocessor based computer systems and network technology continues to improve, their popularity continues to increase. However, before each of these powerful low cost computer systems can be put to productive use, typically a slate of software products including an operating system has to be installed on the computer system, and the operating environment has to be properly configured. Both the typical slate of software products that get installed and the number of operating environment configuration decisions that have to be made continue to grow with the power and capacity of these low cost computer systems. Increasingly, it is not uncommon to find organizations having to install a large number of software products and configure operating environments on tens, hundreds, or even thousands of machines. While the installed software and the operating environments are not uniform across all machines within the organization, they tend to be substantially similar within a class of machines, such as accounting's workstations or engineering's workstations.

One common solution to the problem is to have a typical slate of software products preinstalled and the operating environment pre-configured in a typical configuration at the factory. Experience has shown that this approach is satisfactory only to a minority number of users. The majority of users find themselves to be atypical and having to reinstall the software products and reconfigure the operating environment in order to meet their needs. Additionally, the approach is costly to the manufacturers. It forces earlier cutoff of software development. When changes to one or more of the software products are necessary, existing inventories in the distribution channels will have to be recalled, their software products reinstalled with the latest revisions, and their operating environments reconfigured taking into account the latest revisions. Furthermore, the factory preinstall approach really does not address the need of system administrators who have to install software products and configure operating environments of a class of similar machines.

Thus, it is desirable to automate software installation and operating environment configuration on

computer systems, in particular, microprocessor based computer systems connected in a network. It is further desirable if automated software installation and operating environment configuration can overcome the manufacturing disadvantages of the factory pre-install approach. It is further desirable if the needs of system administrators who have to install software products and configure operating environments for classes of similar machines can be addressed. As will be disclosed, the method and apparatus of the present invention for automatically installing software products and configuring operating environment on a computer system achieves the above described desired results.

## **SUMMARY OF THE INVENTION**

A method and apparatus for automatically installing software products and configuring operating environment on a computer system is disclosed. The method and apparatus of the present invention overcomes the disadvantages of the factory preinstall approach to software installation and operating environment configuration. The present invention allows system administrator to automatically install software products and configure operating environment by machine class. The present invention has particular application to microprocessor based computer systems connected in a network.

Under the present invention, a boot device, a local or remote install media and a local or remote storage device are provided to a computer system. The boot device comprises an install media locator and starter module. The local or remote install media comprises an install set up and control module and an install module. The local or remote storage device comprises a defaulted or a customized collection of installation files. The defaulted/customized collection of installation files comprises a classification rules file, a number of pre-install class script files, a number of install class parameters file, and a number of post-install class script files. Together, these elements cooperate to automatically install software products on the computer system, and configure the operating environment of the computer system.

The install media locator and starter module is loaded into the memory of the computer system and given control as part of the computer system's boot up process. The install media locator and starter module is used to locate a local or a remote media, and starts up the local/remote install set up and control module stored on the located local/remote media. The local/remote install set up and control module is used to determine at least a pre-install class, or an install class, or a post-install class for the computer system. The local/remote install set up and control module makes the class determinations based on the classification rules stored in the defaulted/customized clas-

sification rules file. Additionally, the local/remote install set up and control module is used to start the corresponding defaulted/customized pre-install class script file if a pre-install class is determined, the local/remote install module if an install class is determined, and the corresponding defaulted/customized post-install class script file if a post-install class is determined.

The defaulted/customized pre-install class script files are used to perform pre-installation tasks for the corresponding pre-install classes. The local/remote install module is used to install software products and configure the operating environment of the computer system based on the installation parameters stored in the corresponding defaulted/customized install class parameters file of the determined installation class. The defaulted/customized post-install class script files are used to perform post-installation tasks for the corresponding post-install classes.

Additionally, in the presently preferred embodiment, the defaulted/customized install class parameter file for an install class may be dynamically derived by a defaulted/customized pre-install class script file. The local/remote install set up and control module determines whether the defaulted/customized install class parameter file for an install class is to be dynamically derived or not, and the defaulted/customized pre-install class script file that will do the derivation, based on the rules in the defaulted/customized classification rules file. The local/remote install set up and control module also controls the naming of the derived install class parameters file.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The objects, features, and advantages of the present invention will be apparent from the following detailed description of the presently preferred and alternate embodiments of the invention with references to the drawings in which:

**Figure 1** illustrates an exemplary computer system incorporated with the teachings of the present invention.

**Figure 2** illustrates the contents of the boot device, the local/remote install media, and the local/remote storage devices under the present invention.

**Figure 3** illustrates the operation flow of the install media locator and starter module of the present invention.

**Figure 4** illustrates one embodiment of the install media locator and starter module of the present invention.

**Figure 5** illustrates the operation flow of the local/remote install set up and control module of the present invention.

**Figure 6** illustrates one embodiment of the local/remote install set up and control module of the present invention.

**Figure 7** illustrates exemplary probe functions, corresponding environment variables and comparison functions for the local/remote install set up and control module of **Figure 6**.

**Figure 8** illustrates an exemplary classification rules file of a local/remote collection of installation files.

**Figures 9a - 9b** illustrate an exemplary pre-install class script file of a local/remote collection of installation files.

**Figure 10** illustrates an exemplary install class parameters file of a local/remote collection of installation files.

**Figure 11** illustrates an exemplary post-install class script file of a local/remote collection of installation files.

### **DETAILED DESCRIPTION PRESENTLY PREFERRED AND ALTERNATE EMBODIMENTS**

A method and apparatus for automatically installing software products and configuring operating environment on a computer system is disclosed. The method and apparatus of the present invention overcomes the disadvantages of the factory preinstall approach to software installation and operating environment configuration. The present invention allows system administrator to automatically install software products and configure operating environment by machine class. The present invention has particular application to microprocessor based computer systems connected in a network. In the following description for purposes of explanation, specific numbers, materials and configurations are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well known systems are shown in diagrammatical or block diagram form in order not to obscure the present invention unnecessarily.

Referring now to **Figures 1**, a block diagram illustrating an exemplary computer system incorporated with the teachings of the present invention is shown. Shown is an exemplary computer system 10 comprising a central processing unit (CPU) 12, a memory 14, and an I/O module 16. Additionally, the exemplary computer system 10 also comprises a number of user input/output devices 18, a boot device 20, a local install media 22, and a number of storage devices 24. The CPU 12 is coupled to the memory 14 and the I/O module 16. The user input/output devices 18, the boot device 20, the install media 22, and the storage devices 24 are also coupled to the I/O module 16. The I/O module 16 in turn is coupled to a network 26, through which a remote install media 22' and a number of remote storage devices 24' are accessible to the exemplary computer system 10.

Except for the manner they are used to practice the present invention, the CPU 12, the memory 14, the I/O module 16, the user input/output devices 18, the boot device 20, the local/remote install media, 22 and 22', the local/remote storage devices, 24 and 24', and the network 26, are intended to represent a broad category of these hardware elements found in most computer systems. The constitutions and basic functions of these elements are well known and will not be otherwise further described here. The contents of the boot device 20, the local/remote install media, 22 and 22', and the local/remote storage devices, 24 and 24', and the manner in which these contents cooperate with each other, will be described in further detail with references to the remaining figures.

While the present invention is being described with an exemplary computer system 10 having accesses to both local and remote install media, 22 and 22', as well as local and remote storage devices, 24 and 24', based on the descriptions to follow, it will be appreciated that the present invention may be practiced with the computer system having access to either local or remote install media, and, either local or remote storage devices.

Referring now to Figure 2, a block diagram illustrating the content of the boot device, the local/remote install media, and the local/remote storage devices is shown. The boot device 20 comprises an install media locator and starter module 28. The local/remote install media, 22 or 22', comprises an install set up and control module, 30 or 30', and an install module, 32 or 32'. The local/remote storage devices, 24 or 24', comprise a collection of installation files, 34 or 34', including a classification rules file, 36 or 36', a number of pre-install class script files, 38 or 38', a number of install class parameters files, 40 or 40', and a number of post-install class script files, 42 or 42'. The pre-install class script files, 38 or 38', and the post-install class script files, 42 or 42' are executable files.

In the presently preferred embodiment, the local collection of installation files 34 is the defaulted collection, whereas the remote collection of installation files 34' is the customized collection. While having a local collection of installation files 34 is preferred, it will be appreciated that the present invention may nevertheless be practiced without it. Additionally, while for ease of understanding, the present invention is being described with the defaulted/customized collection of installation files, 34 or 34', being located on local/remote storage devices, 24 or 24', it will be appreciated that the defaulted/customized collection of installation files, 34 or 34', may be located on the local/remote install media, 22 or 22', respectively. In fact, under the presently preferred embodiment, the defaulted collection of installation files 34 is located on the local install media 22. Similarly, while the present invention is being described with the local install

module 32 being located on the install media 22, it will be appreciated that the local install module 32 may be located on the boot device 20. Furthermore, while the present invention is being described with the pre-install and post-install class script files, 38 or 38' and 42 or 42', as executable files, it will be appreciated that the present invention may be practiced with non-executable pre-install and post-install class script files having tokens that can cause equivalent functions to be accomplished.

Continuing to refer to Figure 2, the install media locator and starter module 28 is loaded into the memory of the computer system and given control as part of the computer system's boot up process. The install media locator and starter module 28 is used to locate a local or a remote media, 22 or 22', and starts up the local/remote install set up and control module, 30 or 30', on the local/remote media, 22 or 22'. The local/remote install set up and control module, 30 or 30', is used to determine at least a pre-install class or an install class or a post-install class for the computer system. The local/remote install set up and control module, 30 or 30', makes the class determinations based on the classification rules stored in the defaulted/customized classification rules file, 36 or 36'. Additionally, the local/remote install set up and control module, 30 or 30', is used to start the corresponding defaulted/customized pre-install class script file, 38 or 38'; if a pre-install class is determined, the local/remote install module, 32 or 32', if an install class is determined, and the corresponding defaulted/customized post-install class script file, 42 or 42', if a post-install class is determined. The local/remote install module, 32 or 32', is used to install software products and configure the operating environment of the computer system. The local/remote install module, 32 or 32', installs the software products and configure the operating environment based on the installation parameters stored in the corresponding defaulted/customized install class parameters file, 40 or 40', of the determined installation class. The defaulted/customized pre-install class and post-install class script files, 38 or 38', and, 42 or 42', are used to perform pre-installation and post-installation tasks respectively.

While the defaulted/customized pre-install class and post-install class script files, 38 or 38', and, 42 or 42', are typically used to perform pre-installation and post-installation tasks, and the local/remote install module, 32 or 32', is used to install the software products and configure the operating environment, it will be appreciated that the present invention may be practiced with either the pre-install class script file, 38 or 38', or the post-install class script file, 42 or 42', performing the automatic install and configuration, without involving the install module, 32 or 32', at all. That's why a computer system may have as little as only one classification determined by the automatic install set up and control module, 30 or 30', and the

pre-install script file, 38 or 38', the install module, 30 and 30', and the post-install script file, 40 or 40', are invoked only if corresponding pre-install, install, and post-install classes are determined.

In the presently preferred embodiment, the local/remote install module, 30 or 32', is also used to heuristically determine a number of critical install parameters, if they are not specified in the corresponding defaulted/customized install class parameters file, 40 or 40', of the determined installation class. For example, if the swap size is not specified, the swap size for a stand alone system is set to be one multiple of the memory of the system, whereas, the swap size for a server is set to be another multiple of the memory of the system. In either case, the swap size must also exceeds certain predetermined minimum, but at the same time not greater than certain predetermined maximum. It will be appreciated that what constitutes critical install parameters and the manner they should be heuristically determined are application dependent.

Additionally, in the presently preferred embodiment, the defaulted/customized install class parameter file, 40 or 40', for an install class may be dynamically derived by a defaulted/customized pre-install class script file, 38 or 38'. The local/remote install set up and control module, 30 or 30', determines whether the defaulted/customized install class parameter file, 40 or 40', for an install class is to be dynamically derived or not, and the defaulted/customized pre-install class script file, 38 or 38', that will do the derivation, based on the rules in the defaulted/customized classification rules file, 36 or 36'. The local/remote install set up and control module, 30 or 30', also controls the naming of the derived install class parameters file, 40 or 40'.

Except for the manner, the local/remote install module, 32 or 32', cooperates with the other elements, and the application dependent manner for heuristically determining critical install parameters, the local/remote install module, 32 or 32', is intended to represent a broad category of install procedures found in many computer systems. Its constitutions and basic functions are well known, and therefore will not be otherwise described in further detail. Each of the other elements, 28, 30 and 30', 34 - 42, and 34' - 42', and the manner they cooperate with one another, will be described in further detail below with references to the remaining figures.

Referring now to Figures 3, a block diagram illustrating the preferred operation flow of the install media locator and starter module is shown. Upon given control, the install media locator and starter module probes for remote install media available through the network, block 46. If a remote install media is located through the network, branch 48a, the install media locator and starter module starts up and transfers control to the install set up and control module in the re-

remote media, block 50. On the other hand, if a remote install media is not located through the network, branch 48b, the install media locator and starter module probes for locally available install media, block 52. If a local install media is located, branch 54a, the install media locator and starter module starts up and transfers control to the install set up and control module in the local install media, block 56. If a local install media is also not found, branch 54b, the install media locator and starter module terminates, preferably with error messages describing the problem and suggesting corrective actions. It will be appreciated that the present invention may be practiced with the install media locator and starter module probing for a local install media first.

Additionally, in either case, block 50 or 56, the install media locator and starter module informs the located remote/local install set up and control module that it is being started by an install media locator and starter module. Furthermore, the install media locator and starter module provides its own location to the located remote/local install set up and control module.

Referring now to Figure 4, a block diagram illustrating one embodiment of the install media locator and starter module is shown. In this embodiment, the install media locator and starter module 28 comprises a UNIX® kernel 58 (UNIX is a registered trademark of UNIX System Laboratories), a number of initialization related programs 59, a UNIX® Shell program 60, a set of UNIX® system reconfiguration files 62, and an install media locator and starter routine 64 implemented in Shell having probing and starting logic as described in Figure 3. In this embodiment, the kernel 58 is first loaded into memory and given control, when the computer system is booted. The kernel then starts the initialization and related processes 59, which in turn execute the system reconfiguration files 62. After sufficient system start up and reconfiguration processing has been performed to support the install media locator and starter routine 64, the system reconfiguration files 62 start the install media and locator and starter routine 64.

Under this embodiment, the local and remote install media are identified with predetermined means appropriate for the media. For local install media, such as a CDROM, the identifier comprises a predetermined character string in the machine readable media label. For remote media, the identifier is an entry in the "bootparams" database accessed via a program designed to use that protocol. The install media locator and starter routine 64 assumes the located remote/local install media is a bootable media, and starts the located remote/local install set up and control module by rebooting the located remote/local install media. The install media locator and starter routine 64 further assumes that the located remote/local install set up and control module may also be used for other purposes, such as manual installs or mainte-

nance, and provides the located remote/local install set up and control module with a predetermined character string, such as "FD = <boot device>" or "install", to inform the remote/local install set up and control module of the fact that it is being started by an install media locator and starter module 64 for the purpose of performing an auto install and operating environment configuration. The predetermined character strings are provided as part of the reboot arguments.

In addition, since the boot device comprising the install media locator and starter module 28 is often assumed to be the main system disk where the operating system software is to be installed, it is convenient and useful for the located remote/local install set up and control module to be informed of which disk the install media locator and starter module was located on. Thus, the install media locator and starter routine 64 also provides the located remote/local install set up and control module with the major and minor number of the boot device comprising the install media locator and starter module 28, as part of the reboot arguments.

Referring now to Figure 5, a block diagram illustrating the operating flow of the local/remote install set up and control module is shown. Upon given control, the local/remote install set up and control module probes for customized collection of installation files, block 68. If a customized collection of installation files is found, branch 70a, the local/remote install set up and control module selects the located customized collection of installation files. Otherwise, the local/remote install set up and control module selects the defaulted collection of installation file, block 74.

Upon selecting either the defaulted or customized collection of installation files, the install set up and control module probes for system configuration information, block 76. The install set up and control module then classifies the computer system, assigning at least a pre-install class, an install class, or a post-install class, based on the system configuration information received, and using the classification rules in the classification rules file in the selected collection of installation files, block 78. Additionally, if the computer system is to be assigned an install class, and the corresponding install class parameters file is to be dynamically derived by a pre-install class script file, the install set up and control module names the install class arbitrarily. A computer system with an arbitrarily named install class having a dynamically derived install class parameters file, by definition, always has a pre-install class.

If a pre-install class is assigned, branch 80a, the install set up and control module then starts the corresponding pre-install class script file in the selected collection of installation files, block 82. If the pre-install script file is to derive an install class parameter file, the install set up and control module provides the pre-install script file with the name of the assigned in-

stall class. If no pre-install class is assigned or upon returning from the pre-install class script file, the install set up and control module determines if an install class is assigned, block 83.

If a pre-install class is assigned, branch 83a, the install set up and control module then starts the install module providing it with the name of the assigned install class, block 84. As described earlier, the install module installs software products and configures the operating environment of the computer system in accordance to the corresponding (derived) defaulted/customized install class parameters file of the determined install class, heuristically determining the unspecified critical install parameters if necessary. If no install class is assigned or upon returning from the install module, the install set up and control module determines if a post-install class is assigned, block 86.

If a post-install class is assigned, branch 86a, the install set up and control module then starts the corresponding post-install class script file of the post-install class determined. If no post-install class is assigned, branch 84b, or upon returning from the started post-install class script file, the install set up and control module terminates.

Referring now to Figures 6 and 7, two block diagrams illustrating one embodiment of the local/remote install set up and control module is shown. In this embodiment, the local/remote install set up and control module, 30 or 30', comprises a UNIX® kernel 90, a number of initialization related programs 91, a UNIX® Shell program 92, a set of UNIX® reconfiguration files 94, an install set up and control routine 96 implemented in Shell having probing and starting logic as described in Figure 5, a number of probe functions 98, and a number of comparison functions 100. The results of the probe functions 98 are saved in environment variables. A number of exemplary probe functions 98, and their corresponding environment variables 102, and comparison functions 100 are shown in Figure 7.

Still referring to Figure 6, as described earlier, the local/remote install set up and control module, 30 or 30', is started by the install media locator and starter module by rebooting the computer system off the located local/remote install media. The kernel 90 is loaded into memory and given control, when the computer system is rebooted off the located local/remote install media. The kernel 90 then starts the initialization and related processes 91, which in turn starts the reconfiguration files 94. After sufficient system start up and reconfiguration processing has been performed to support the install set up and control routine 96, the reconfiguration files 94 start the install set up and control routine 96. The install set up and control routine then assigns at least a pre-install class, or an install class, or a post-installed class, as described earlier, using the probe and comparison functions, 98

and 100. Upon determining the various classes, the install set up and control routine 96 then selectively invokes the defaulted/customized pre-install script file, the install module, and the defaulted/customized post-install script files.

Referring now to Figures 8 - 12, four block diagrams illustrating an exemplary classification rules file, an exemplary pre-install class script file, an exemplary install class parameters file, and an exemplary post-install class file are shown. Figure 8 illustrates an exemplary classification rules file, 36 or 36', comprising a number of exemplary rules, 104a - 104g. Each exemplary rule, 104a, ..., or 104g, comprises a number of configuration characteristics matching criteria, and at least one exemplary pre-install class, or an exemplary install class, or an exemplary post-install class. For this exemplary classification rules file, 36 or 36', the pre-install, install, and post-install classes are specified in order at the end of a rule, 104a - 104g. Additionally, the character '-' denotes that the computer system with the matching configuration characteristics does not have a pre-install, install, or post-install class, and the character '=', used only for install class, denotes that the install class parameters file is to be derived by the pre-install class script file for the computer system with the matching configuration characteristics. For examples, the character '-' before the exemplary install classes "class\_2x104", "class\_1x207\_t3", and "class\_104\_207" in exemplary rules 104a - 104c denotes that computer systems matching the criteria of any one of these rules do not have pre-install classes, and the character '=' after the exemplary pre-install classes "derive\_class2x104", "derive\_class\_1x207", "derive\_class\_104\_207" and "derive\_class\_104\_207" in exemplary rules 104d - 104g denotes that computer systems matching the criteria of any one of these rules are to have their install class parameters files derived.

Figure 9 illustrates an exemplary pre-install class script file, 38 or 38', comprising a number of exemplary statements for performing various exemplary pre-installation tasks. In particular, the exemplary pre-install class script file, 38 or 38', comprises a number of exemplary statements 106 for performing exemplary "German" and "French" localizations for the operating system and windows to be installed. Figure 10 illustrates an exemplary install class parameters file, 40 or 40', comprising a number of exemplary install parameters for the exemplary install class, such as "System\_Type" being "Standalone", "Clusters" to be assigned being "SUNWCreq" and "SUNWCadm", and "Packages" to be installed being "SUNWesu", "SUNWhea", and "SUNWinst". Lastly, Figure 11 illustrates an exemplary post-install class script file, 42 or 42', comprising a number of exemplary statements for performing various exemplary post-installation tasks. In particular, the exemplary

post-install class script file, 42 or 42', comprises a number of exemplary statements 108 for reestablishing the search path to the compilers.

While the present invention has been described in terms of presently preferred and alternate embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The method and apparatus of the present invention can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is thus to be regarded as illustrative instead of limiting on the present invention.

## Claims

1. In a computer system, a method for automatically installing a plurality of software products on said computer system and configuring said computer system's operating environment, said method comprising the steps of:
  - a) booting an install media locator and starter module from a boot device into said computer system's memory, and transferring control to said install media locator and starter module booted into said memory;
  - b) locating an install media comprising an automatic install set up and control module, and transferring control to said automatic install set up and control module, with said install media locator and starter module booted into said memory;
  - c) locating a collection of installation files comprising a classification rules file with said automatic install set up and control module;
  - d) determining at least one classification for said computer system with said automatic install set up and control module using said located classification rules file; and
  - e) installing said plurality of software products on said computer system, and configuring said computer system's operating environment automatically under the control of said automatic install set up and control module using said at least one classification determined.
2. The method as set forth in claim 1, wherein,
  - said install media locator and starter module comprises an operating system with minimal functions, a plurality of initialization and related processes, a command-like language interpreter, a set of system reconfiguration files, and an install media locator and starter routine;
  - said step a) comprises the steps of:
    - a.1) booting said operating system into said memory, and transferring control to said operating system booted into said memory;



- a.2) loading said initialization and related processes into memory, and starting execution of said initialization and related processes under the control of said operating system booted into said memory; 5
- a.3) loading said system reconfiguration files into said memory and starting execution of said system reconfiguration files under the control of said operating system and said command-like language interpreter; and 10
- a.4) loading said install media locator and starter routine into said memory and starting execution of said install media locator and starter routine under the control of said operating system and said command-like language interpreter. 15
3. The method as set forth in claim 1, wherein, said located automatic install set up and control module in said step b) comprises an operating system with minimal functions, a plurality of initialization and related processes, a command-like language interpreter, a set of configuration files, an automatic install set up and control routine, a plurality of probe functions, and a plurality of compare functions; 20
- said control transfer in said step b) is achieved by rebooting said automatic install set up and control module into said memory, and transferring control to said automatic install set up control module booted into said memory. 25
4. The method as set forth in claim 1, wherein, said install media located in said step b) is a selected one of i) a local install media of said computer system and ii) a remote install media coupled to said computer system through a network; and 35
- said collection of installation files located in said step c) is a selected one of i) a defaulted collection of installation files and ii) a customized collection of installation files, said defaulted collection of installation files being stored on a selected one of i) local storage means of said computer system and ii) a local install media coupled said computer system, said customized collection of installation files being stored in a selected one of i) remote storage means coupled to said computer system through a network, and ii) a remote install media coupled to said computer system through a network. 40
5. The method as set forth in claim 1, wherein, said collection of installation files located in said step c) further comprises a plurality of pre-install script files corresponding to a plurality of pre-install classes for performing pre-installation tasks; 45
- said at least one classification determined in said step d) comprises a pre-install class for said computer system; and
- said step e) comprises executing the pre-install script file corresponding to said determined pre-install class under the control of said automatic install set up and control module.
6. The method as set forth in claim 5, wherein, said pre-installation tasks performed by said pre-install script file corresponding to said determined pre-install class comprise deriving an install class parameters file for an install class, said at least one classification determined in said step d) further comprising said install class; 50
- said step e) further comprises executing an install module using said derived install parameters file under the control of said automatic install set up and control module, a selected one of said boot device and said located install media in said step b) further comprising said install module.
7. The method as set forth in claim 5, wherein, said pre-installation tasks performed by said pre-install script file corresponding to said determined pre-install class comprise localization of said automatic installation and configuration to be performed in said step e).
8. The method as set forth in claim 1, wherein, a selected one of said boot device and said install media located in said step b) further comprises an install module; 55
- said collection of installation files located in said step c) further comprises a plurality of install class parameters files corresponding to a plurality of install classes;
- said at least one classification determined in said step d) comprises an install class; and
- said step e) comprises executing said install module using the install class parameters file corresponding to said determined install class under the control of said automatic install set up and control module.
9. The method as set forth in claim 8, wherein, said install module in said step e) heuristically determines critical install parameters unspecified in said install class parameters file corresponding to said determined install class.
10. The method as set forth in claim 1, wherein, said collection of installation files located in said step c) further comprises a plurality of post-install script files corresponding to a plurality of post-install classes; 60
- said step d) comprises determining a post-



install class for said computer system with said automatic install set up and control module using said classification rules file; and

said step e) comprises executing the post-install script file corresponding to said determined post-install class with said automatic install set up and control module.

11. In a computer system, an apparatus for automatically installing a plurality of software products on said computer system and configuring said computer system's operating environment, said apparatus comprising:

a) booting means coupled to said computer system's processor and memory comprising an install media locator and starter module for booting said install media locator and starter module into said memory, and transferring control to said install media locator and starter module booted into said memory;

b) install media coupled to said computer system's processor and memory comprising an automatic install set up and control module for determining at least one classification for said computer system, said install media being located and said automatic install set up and control module being loaded into said memory and given control by said install media locator and starter module booted into said memory; and

c) file subsystem means coupled to said computer system's processor and memory for storing a collection of installation files comprising a classification rules file, said file subsystem means being located and said classification file being used to determine said at least one classification of said computer system by said automatic install set up and control module loaded in said memory;

said automatic install set up and control module automatically causing said plurality of software products to be installed on said computer system and said computer system's operating environment to be configured under its control using said at least one classification determined.

12. The apparatus as set forth in claim 11, wherein, said install media locator and starter module comprises an operating system with minimal functions, a plurality of initialization and related processes, a command-like language interpreter, a set of system reconfiguration files, and an install media locator and starter routine;

said booting means boots said install media locator and starter module into said memory and gives it control by

booting said operating system into said memory, and giving control to said operating

system booted into said memory,

loading said initialization and related processes into said memory and executing said loaded initialization and related processes under the control of said operating system,

loading said system reconfiguration files into said memory and executing said loaded system reconfiguration files under the control of said operating system and said command-like language interpreter, and

loading said install media locator and starter routine into said memory and executing said loaded install media locator and starter routine under the control of said operating system and said command-like language interpreter.

13. The apparatus as set forth in claim 11, wherein, said located automatic install set up and control module comprises an operating system with minimal functions, a plurality of initialization and related processes, a command-like language interpreter, a set of configuration files, an automatic install set up and control routine, a plurality of probe functions, and a plurality of compare functions;

said control transfer to said located automatic install set up and control module is achieved by rebooting said automatic install set up and control module into said memory, and transferring control to said automatic install set up control module booted into said memory.

14. The apparatus as set forth in claim 11, wherein, said install media is a selected one of i) a local install media of said computer system and ii) a remote install media coupled to said computer system through a network; and

said collection of installation files stored in said file subsystem means is a selected one of i) a defaulted collection of installation files, and ii) a customized collection of installation files, said file subsystem means storing said defaulted collection of installation files being a selected one of i) local storage means of said computer system, and ii) a local install media coupled said computer system, said file subsystem means storing said customized collection of installation files being a selected one of i) remote storage means coupled said computer system through a network, and ii) a remote install media coupled to said computer system through a network.

15. The apparatus as set forth in claim 11, wherein, said collection of installation files stored in said file subsystem means further comprises a plurality of pre-install script files corresponding to a plurality of pre-install classes for performing pre-installation tasks;

said at least one classification determined comprises a pre-install class for said computer system; and

said automatic installation and configuration caused by said automatic install set up and control module comprises executing the pre-install script file corresponding to said determined pre-install class under its control.

comprises a post-install class; and

said automatic installation and configuration caused by said automatic install set up and control comprises executing the post-install script file corresponding to said determined post-install class under its control.

16. The apparatus as set forth in claim 15, wherein,
  - said pre-installation tasks performed by said pre-install script file corresponding to said determined pre-install class comprise driving an install class parameters file for an install class, said at least one classification determined further comprising said install class;
    - said automatic installation and configuration caused by said automatic install set up and control module comprises executing an install module using said derived install parameters file under its control, a selected one of said boot device and said located install media further comprising said install module.
17. The apparatus as set forth in claim 15, wherein,
  - said pre-installation tasks performed by said pre-install script file corresponding to said determined pre-install class comprise localizing said automatic installation and configuration.
18. The apparatus as set forth in claim 11, wherein,
  - a selected one of said boot device and said install media further comprises an install module;
    - said collection of installation files further comprises a plurality of install class parameters files corresponding to a plurality of install classes;
      - said at least one classification determined comprises an install class; and
        - said automatic installation and configuration caused by said automatic install set up and control module comprises executing said install module using the install class parameters file corresponding to said determined install class under its control.
  19. The apparatus as set forth in claim 18, wherein,
    - said install module heuristically determines critical install parameters unspecified in said install class parameter file corresponding to said determined install class.
  20. The apparatus as set forth in claim 11, wherein,
    - said collection of installation files stored in said file subsystem means further comprises a plurality of post-install script files corresponding to a plurality of post-install classes;
      - said at least one classification determined

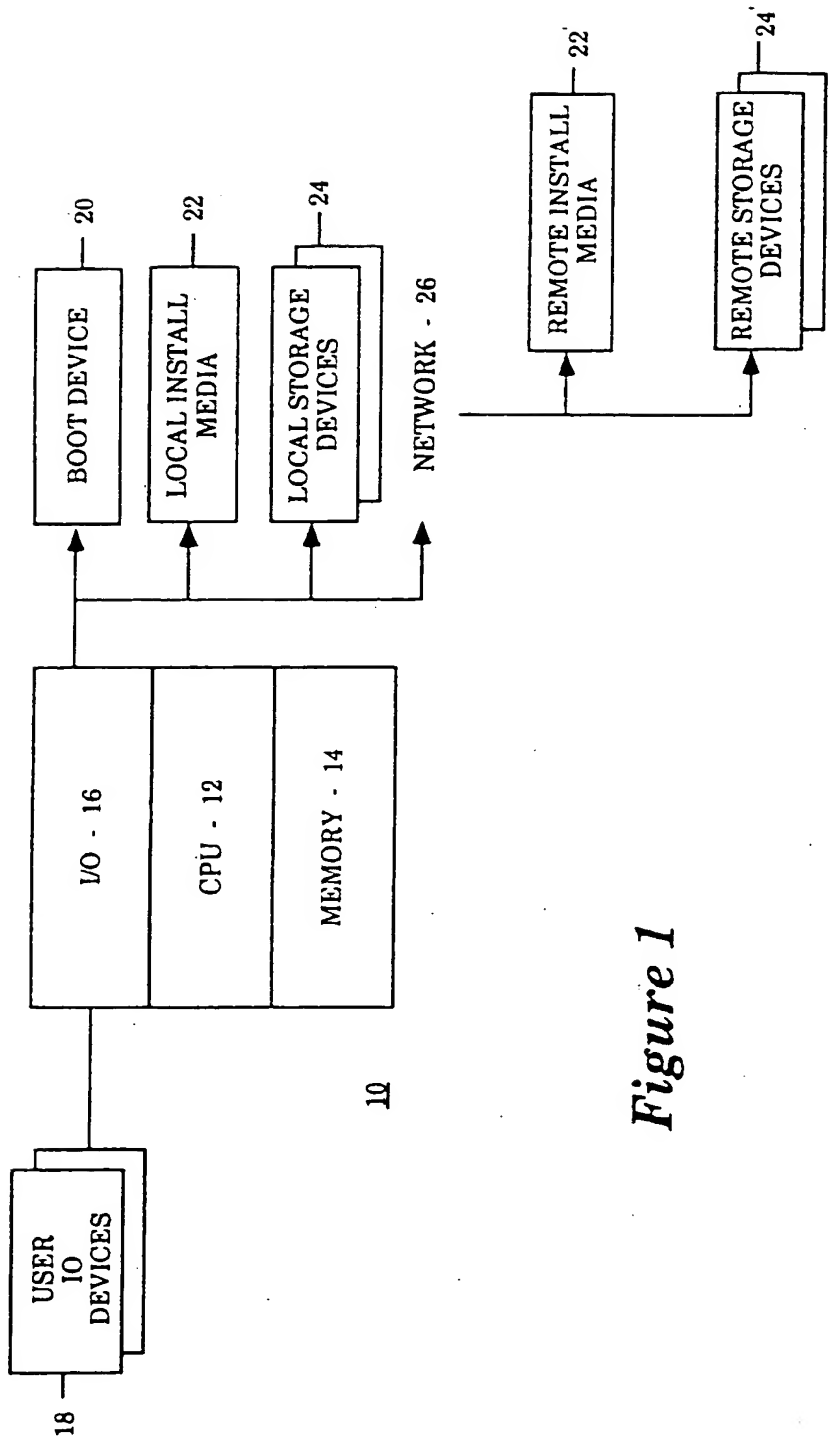
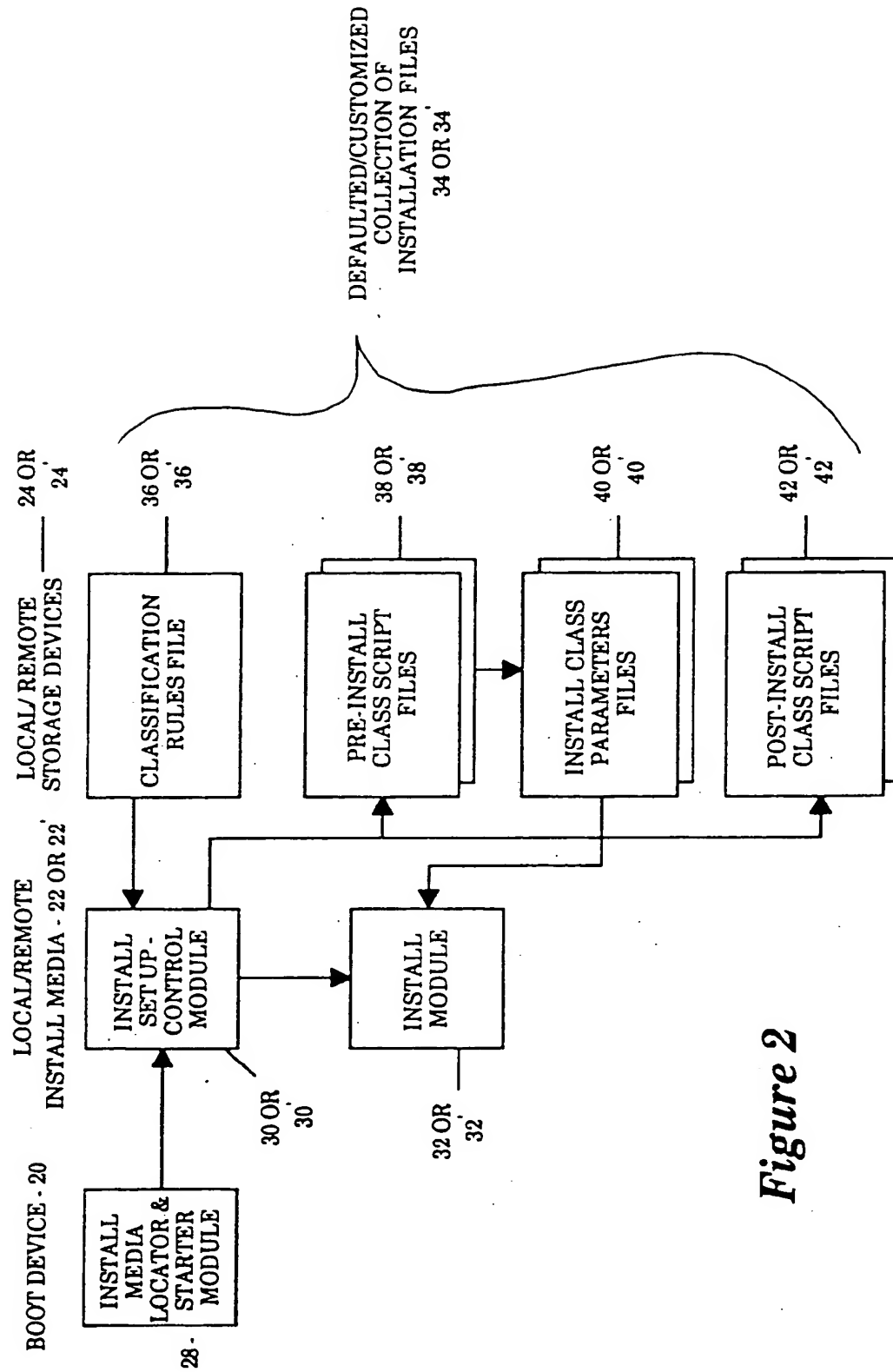
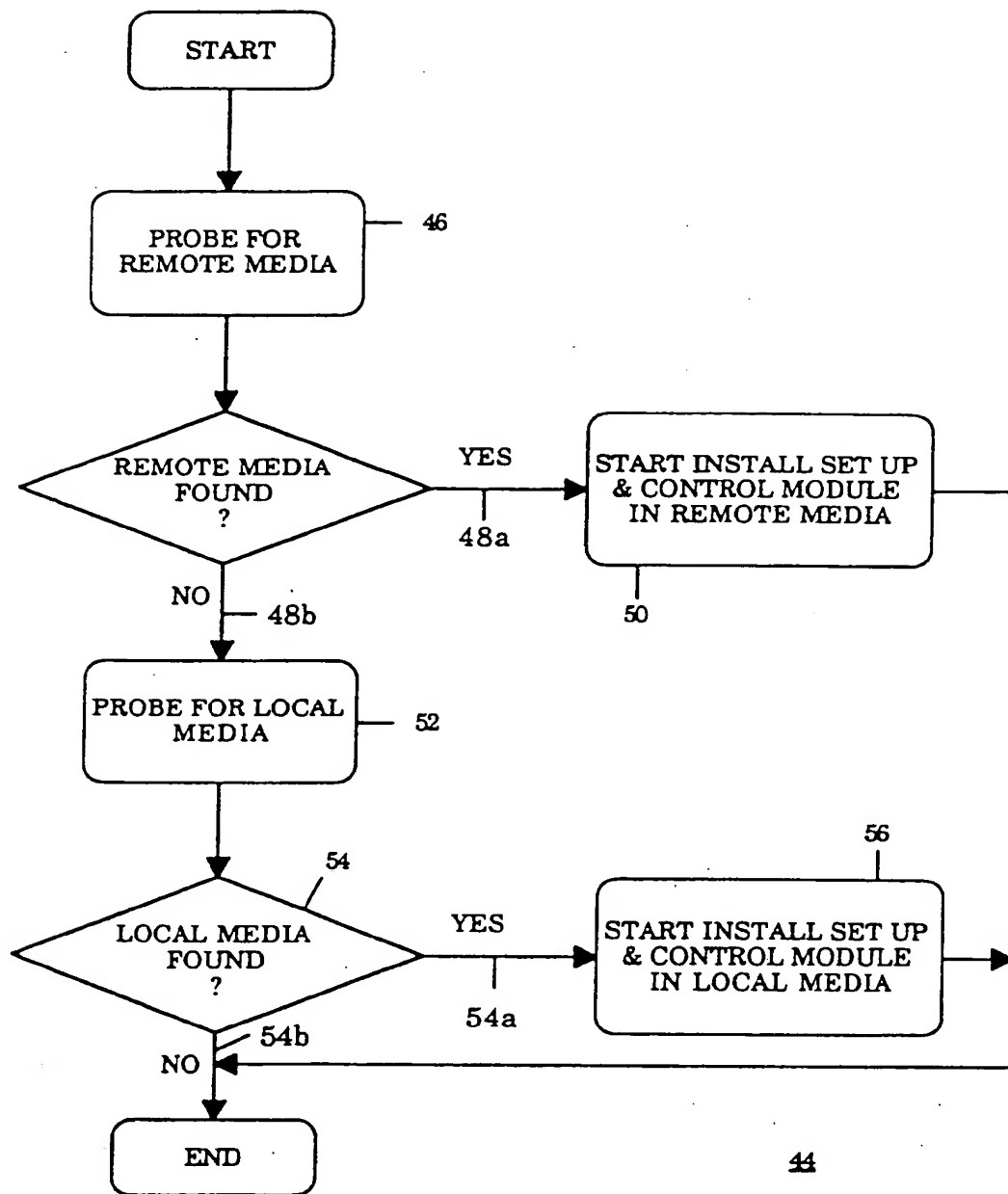
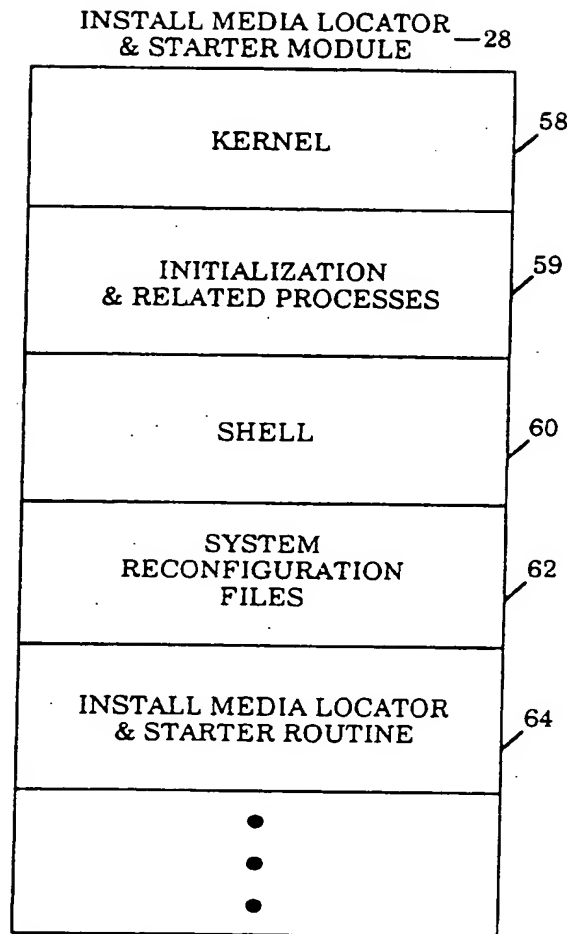


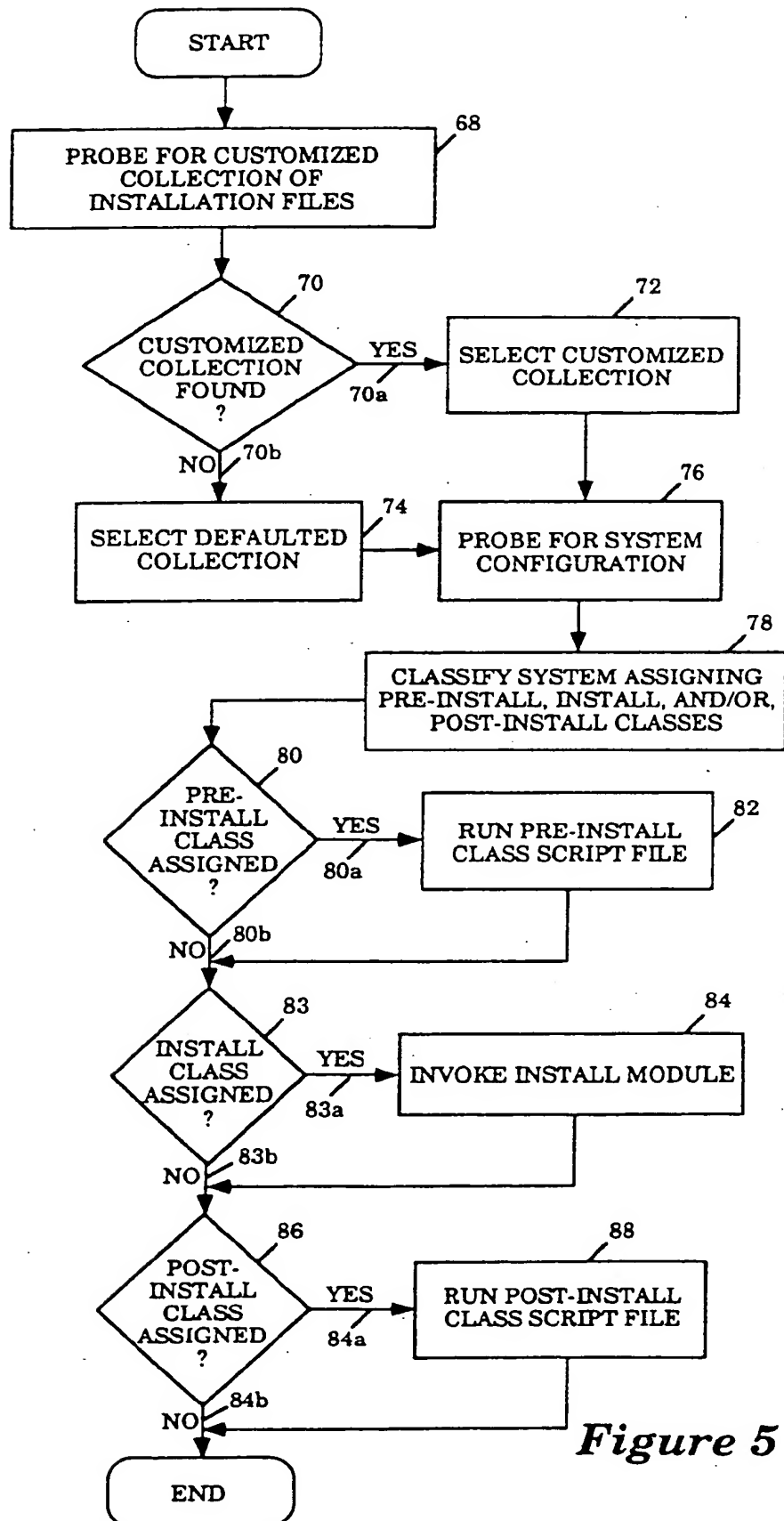
Figure 1



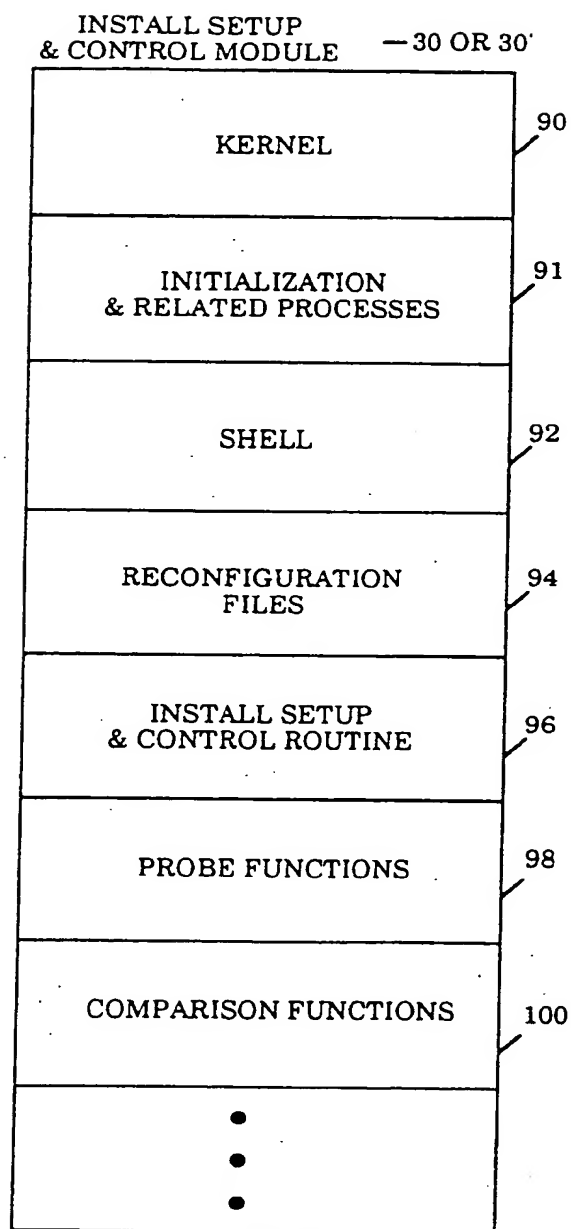
**Figure 3**



*Figure 4*

*Figure 5*





**Figure 6**

98 PROBE FUNCTIONS	102 ENVIRONMENT VARIABLES	100 COMPARE FUNCTIONS
PROBE _ HOSTNAME PROBE _ HOSTADDRESS PROBE _ NETWORK PROBE _ DOMAINNAME PROBE _ ROOTDISKSIZE PROBE _ ARCH PROBE _ KARCH PROBE _ MODEL PROBE _ MEMSIZE PROBE _ USERCHOICE PROBE _ HOSTID	SI _ HOSTNAME SI _ HOSTADDRESS SI _ NETWORK SI _ DOMAINNAME SI _ ROOTDISKSIZE SI _ ARCH SI _ KARCH SI _ MODEL SI _ MEMSIZE SI _ USERCHOICE SI _ HOSTID	CMP _ HOSTNAME CMP _ HOSTADDRESS CMP _ NETWORK CMP _ DOMAINNAME CMP _ ROOTDISKSIZE CMP _ ARCH CMP _ KARCH CMP _ MODEL CMP _ MEMSIZE CMP _ USERCHOICE CMP _ HOSTID

Figure 7

## CLASSIFICATION RULES FILE

36 OR 36'

```

# common: 2x104 disks
104a/ karch sun4c && disksize c0t3d0s0 40-107 && disksize c0t1d0s0 \
      40-107 && numdisks 2 - class_2x104 finish_XXX

# common: 1x207 disks
104b/ karch sun4c && disksize c0t3d0s0 107-210 && numdisks 1 \
      - class_1x207_t3 finish_XXX

# common: 1x104 & 1x207 disks
104c/ karch sun4c && disksize c0t3d0s0 40-107 && disksize c0t1d0s0 \
      107-210 && numdisks 2 - class_104_207 finish_XXX

##### OR, using derived profiles #####
#
# common: 2x104 disks
104d/ disksize c0t3d0s0 40-107 && disksize c01d0s0 40-107 && \
      numdisks 2 derive_class_2x104 = finish_XXX

# common: 1x207 disks
104e/ totaldisk 107-210 && numdisks 1 \
      derive_class_1x207 = finish_XXX

# common: 1x104 & 1x207 disks
104f/ disksize c0t3d0s0 40-107 && disksize c0t1d0s0 107-210 && \
      numdisks 2 derive_class_104_207 = finish_XXX
104g/ disksize c0t1d0s0 40-107 && disksize c0t3d0s0 107-210 && \
      numdisks 2 derive_class_104_207 = finish_XXX

```

*Figure 8*

**Figure 9a**

PRE-INSTALL CLASS SCRIPT FILE

38 OR 38'

```
##### functions #####
bailout () {
    echo ""
    echo "$1"
    echo ""
    echo "type <return> to continue"
    read ans
    exit 1
}

##### MAIN Main main #####

# from SI DISKLIST, get the names of the disks
if [ ! "$(SI_DISKLIST)" ]; then
    bailout "$(0) : SI_DISKLIST not set"
fi

# ASSUME just two disks, could verify via SI_NUMDISKS

first=`expr $(SI_DISKLIST) : '\(c[0-9]*t*[0-9]*d[0-9]*\)'.*`
second=`expr $(SI_DISKLIST) : 'c[0-9]*t*[0-9]*d[0-9]*.*\(.*\).*`
if [ ! $(first) ]; then
    bailout "$(myname) : cannot find first disk,
    SI_DISKLIST: $(SI_DISKLIST)"
fi
if [ ! $(second) ]; then
    bailout "$(myname) : cannot find 2nd disk,
    SI_DISKLIST: $(SI_DISKLIST)"
fi
if [ "$(first)" = c0t3d0 ]; then
    ROOT=$(first)
    USR=$(second)
elif [ "$(second)" = c0t3d0 ]; then
    ROOT=$(second)
    USR=$(first)
else
    ROOT=$(first)
    USR=$(second)
fi
cat << ZZZ >> $(PROFILE)
install_type Initial_install
system_type Standalone
filesys $(ROOT)s0 16 / ufs
filesys $(ROOT)s1 50- swap swap
filesys $(ROOT) s5 10- /opt ufs
filesys $(USR)s2 90- /usr ufs
cluster SUNWCuser
ZZZ
```

**continued in Figure 9b**

continued from Figure 9a

```
# add the localization packages to the profile
#
# This list could come from a file and/or be calculated some way,
# perhaps by looking at the keyboard type.
# In this example both the os and windows localizations are added
# for German (de) and French (fr)
lpkgs=`cat <<ZZZ
SUNWdeos
SUNWdeow
SUNWfros
SUNWfrow
ZZZ`

for p in ${lpkgs} ; do
    echo "adding localization package: ${p}"
    echo "package ${p} add" >> ${PROFILE}
done
```

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# for log

38 OR 38'

**Figure 9b**

## INSTALL CLASS PARAMETERS FILE

40 OR 40'

INSTALL_TYPE	INITIAL_INSTALL
SYSTEM_TYPE	STANDALONE
FILESYS	/DEV/DSK/C0T3D0S0 16 / UFS
FILESYS	C0T3D0S1 33 SWAP SWAP
FILESYS	/DEV/DSK/C0T3D0S6 40- /USR UFS
CLUSTER	SUNWCreq
CLUSTER	SUNWCadm
PACKAGE	SUNWesu
PACKAGE	SUNWhea
PACKAGE	SUNWinst

•  
•  
•

*Figure 10*

## POST-INSTALL CLASS SCRIPT FILE

42' OR 42'

```

set -x

#####
#
# set vfstab additions
#
# everytime I reinstall, the path to the compilers changes!
DISTSERVER="infidel-111"
CSERVER="infidel-111"
#
CPATH=`(cd/net/${CSERVER}/export/mars/sunpro ; /bin/ls | \
      read one rest ; echo $one)`
#
echo "DDD: CPATH is: ${CPATH}"
#
mkdir /a/usr/dist
mkdir /a/opt
mkdir /a/opt/SUNWSpro
#
cat <<XXX>> /a/etc/vfstab
${DISTSERVER} : /export/dist -      /usr/dist nfs - yes ro
${CSERVER} : /export/mars/sunpro/2.0.1/SUNWspro
           - /opt/SUNWSpro nfs - yes ro
${CSERVER} : /export/mars/openwinV3.1/alpha3.1 - /usr/openwin nfs
           - yes ro
XXX

#####
#
# add root password hands off
#
# use sed to chop off the "root" line of shadow
sed '/^root:/d' /a/etc/shadow > /tmp/t1
cat ${SI_CONFIG_DIR}/.stuff/gs /tmp/t1 > /tmp/t2
mv /tmp/t2 /a/etc/shadow
chmod 400 /a/etc/shadow
rm /tmp/t1
# twiddle the sysIDtool.state file
sed '/ [rR]oot.*[pP]ass/s/0/1/p' /a/etc/.sysIDtool.state > /tmp/t3
mv /tmp/t3 /a/etc/.sysIDtool.state

echo "finished with finish"

```

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*Figure 11*





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(71) Applicant: **SUN MICROSYSTEMS, INC.**  
**2550 Garcia Avenue**  
**Mountain View, CA 94043 (US)**

(72) Inventor: **Owens, Gary L.**  
**111 N. Rengstorff, Apt. 173**  
**Mountain View, California 94043 (US)**  
Inventor: **Labuda, David**  
**213 Correas Avenue**  
**Half Moon Bay, California 94019 (US)**

(74) Representative: **Wombwell, Francis**  
**Potts, Kerr & Co.**  
**15, Hamilton Square**  
**Birkenhead Merseyside L41 6BR (GB)**

(54) **Automated software installation and operating environment configuration on a computer system.**

(57) A boot device, a local or remote install media, and a local or remote storage device are provided to a computer system. The boot device comprises an install media locator and starter module. The local or remote install media comprises an install set up and control module and an install module. The local or remote storage device comprises a defaulted or a customized collection of installation files. The defaulted/customized collection of install files comprise a classification rules file, a number of pre-install class script files, a number of install class parameter files, and a number of post-install class script files. Together, these elements cooperate to automatically install software products on the computer system, and configure the operating environment of the computer system.

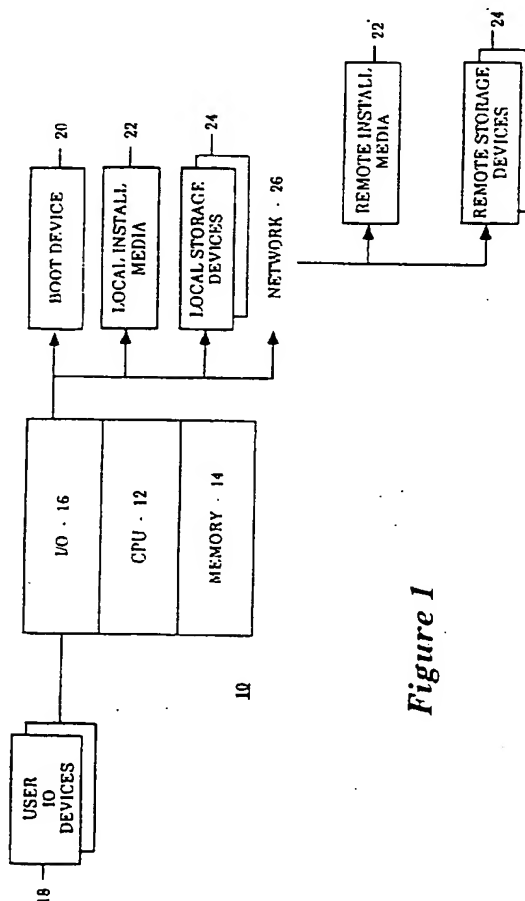


Figure 1

EP 0 592 079 A3



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 93 30 5982

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cls)
Y	SUMMER CONF. PROC., 9 June 1986, USENIX ASSOC., EL CERRITO, US pages 159 - 171 DANIEL NACHBAR 'When network file systems aren't enough: automatic software distribution revisited' * the whole document *	1,3,4	G06F9/445
Y	PATENT ABSTRACTS OF JAPAN vol. 13, no. 397 (P-928) 5 September 1989 & JP-A-01 142 857 (NEC CORP) 5 June 1989 * abstract *	1,3,4	
A	IBM TECHNICAL DISCLOSURE BULLETIN., vol.32, no.9A, September 1990, NEW YORK US pages 407 - 408 'Initialization code executed after Post and before the operating system gets control' * the whole document *	1	
A	IBM TECHNICAL DISCLOSURE BULLETIN., vol.28, no.4, September 1985, NEW YORK US page 1441 'Configuration file comprising configuration commands and data' * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int.Cls) G06F
A	NL-A-8 902 501 (OCÉ-NEDERLAND B.V.) -----	2	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 July 1994	Examiner Kingma, Y
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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